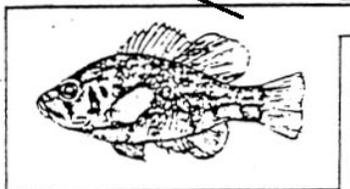


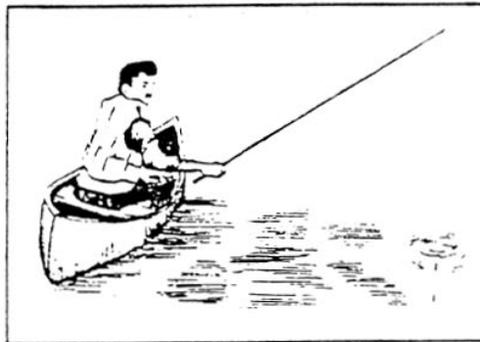
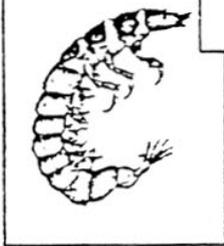
WATER QUALITY STUDY OF HARRODS CREEK



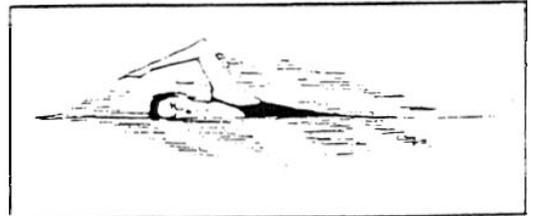
Outstanding
Resource
Waters



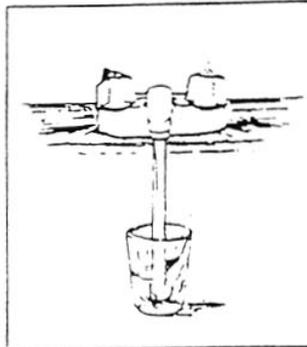
Aquatic
Life



Recreation



Natural Resources and
Environmental Protection Cabinet



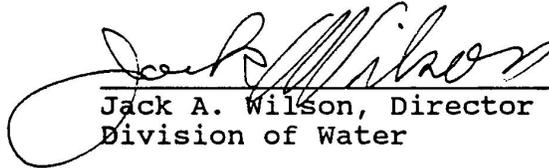
Domestic
Use

Kentucky Division of Water
Department for Environmental Protection
October, 1990

WATER QUALITY STUDY OF HARRODS CREEK

KENTUCKY DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER
WATER QUALITY BRANCH
Frankfort, Kentucky

This report has been approved for release:



Jack A. Wilson, Director
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12-7-90
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Introduction

Harrods Creek begins in Henry County and flows 31 miles through Oldham and Jefferson Counties to its confluence with the Ohio River above Louisville. Along its route are areas of Oldham and Jefferson County that have experienced rapid growth, and new development is under construction. Much of the watershed is not served by a centralized sewage disposal system; instead package systems have been installed to meet the waste disposal needs of individual developments.

In 1987, the Division of Water (Division) became concerned about water quality conditions in Harrods Creek, particularly the lower four miles which are in backwater from the Ohio River. The u.s. Geological Survey (USGS) responded to a request to conduct streamflow measurements throughout the basin, and much lower flows were measured than were expected. In 1988, these lower flows were incorporated in the QUAL2E water quality computer model, which then predicted that lower Harrods Creek did not meet Kentucky's dissolved oxygen (DO) standard of 5.0 milligrams per liter (mg/L). Also in 1988, the Metropolitan Sewer District (MSD), in cooperation with the USGS, began a stream sampling program throughout Jefferson County. Measurements made by these agencies showed that dissolved oxygen standards were not being met at their station on Harrods Creek, located 3.2 miles upstream of the Ohio River.

The Division, in an effort to improve water quality conditions in Harrods Creek, began requiring more strict effluent limits from existing wastewater facilities, denying construction of new package wastewater facilities, and supporting MSD's North County Action Plan. This plan will extend sewer lines into the area, eliminating existing wastewater facilities. In order to accommodate ongoing development, the Division has approved expansion of the three facilities owned by the City of Prospect. The expanded facilities will have stricter permit limits than their current requirements, with a theoretical net reduction of pollutant loadings into the stream. In addition, the Division committed to conduct a water quality survey of Harrods Creek during critical low flow conditions to verify the low DO levels predicted by the QUAL2E model and previous sampling. Although originally scheduled for the summer of 1989, stream flow did not reach the desired low-flow conditions, and the study was delayed. Conditions in 1990 were more representative, and the study was conducted on July 10 and 11. This report presents the results of the study.

Description of Study Area

Harrods Creek drains 108 square miles of Henry, Oldham, and Jefferson Counties. Major tributaries are Ash Run, Brush Creek, Cedar Creek, Darby Creek, and South Fork Harrods Creek. Stream slopes are moderate to flat: about 15 feet per mile from the headwater to mile 15 above Darby Creek; about 10 feet per mile to mile 7.5 above South Fork Harrods Creek; about 5 feet per mile to mile 4.2, and virtually no slope in the lower 4.2 miles, which is in backwater from the Ohio River. The backwater is greater than 50 feet wide and 15 feet deep in places. Water elevation in this area is controlled by the pool stage of the Ohio, which in turn is controlled by the McAlpine Lock and Dam at Louisville. There are 33 active wastewater facilities in the basin, which include schools, small industrial plants, residential subdivisions, and MSD's Hite Creek regional facility. Location of wastewater facilities are noted on Figure 1 and described in Table 1.

Water quality sampling was conducted in the lower half of the basin because this is the area of most concern. The study area begins at the confluence of Darby Creek with Harrods Creek (milepoint 12) and extends to the Ohio River. The section from Darby Creek to mile 4.2 is a pool and riffle reach. Pools are 40 to 60 feet wide and 1 to 2 feet deep in places, with short narrow riffles separating them. Location of sampling sites are also noted on Figure 1, and described in Table 2.

Fig. 1. Harrods Creek basin

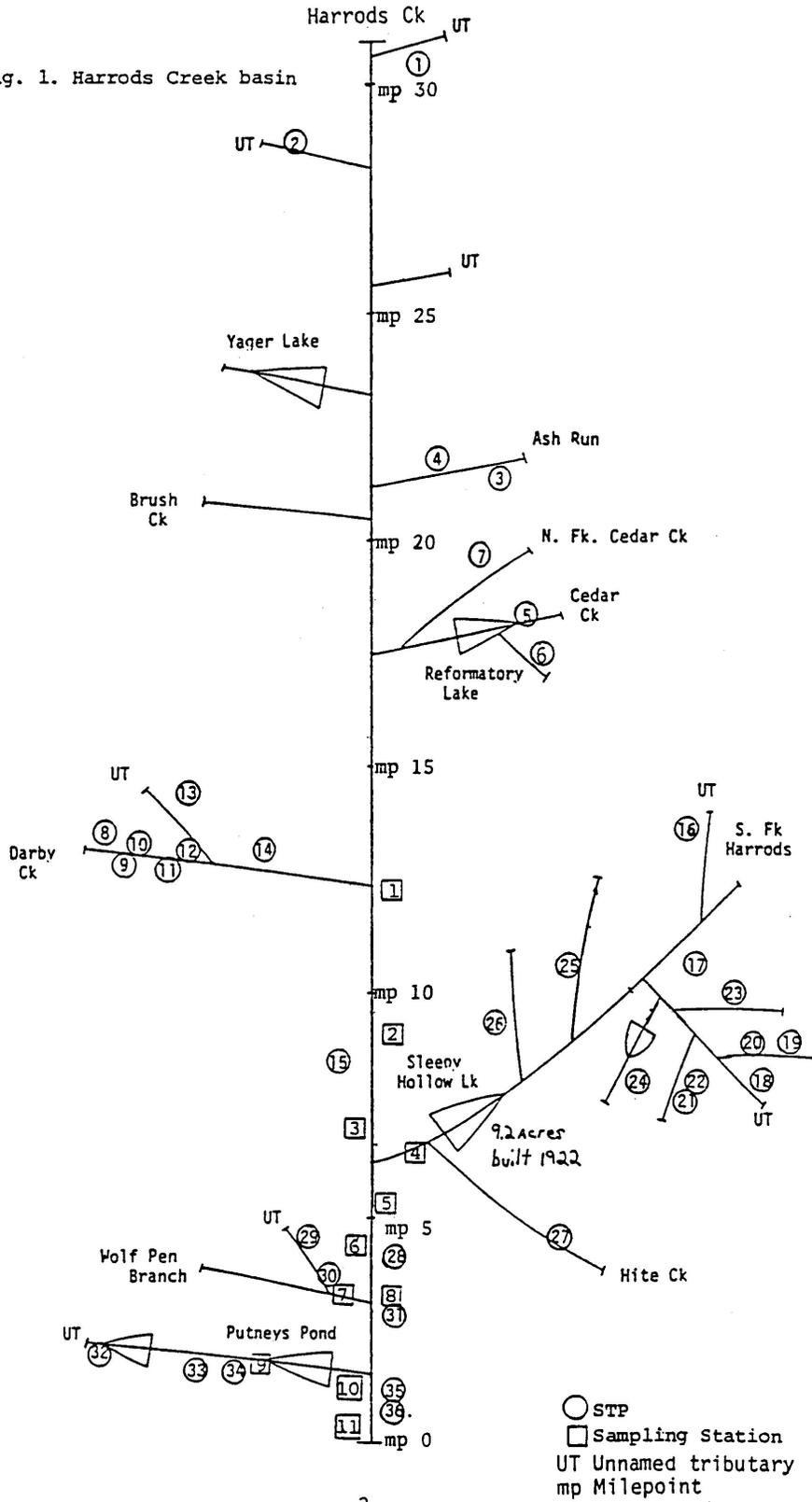


TABLE 1. WASTEWATER FACILITIES IN THE HARRODS CREEK BASIN

MAP #	NAME	DESIGN FLOW (MGD)*
1	LAKE JERRICO VE14EER	0.005
2	STUCKY'S RESTAURANT	0.029
3	ANAMAG	0.005
4	OLDHAM WOODS SUBDIV	0.178
5	CLAYTON AND LAMBERT	0.025
6	DISCONTINUED	
7	KY DOJ REFORMATORY	0.650
8	OLDHAM COUNTY H.S.	0.015
9	OLDHAM CO JR HIGH	0.007
10	OLDHAM CO VOCATIONAL	0.003
11	OLDHAM CO MIDDLE SCH	0.012
12	HEATHER HILL SUBDIV	0.070
13	MOCKINGBIRD VALLEY SUB.	0.040
15	PARAMONT SUBDIVISION	0.400
16	PARKLAKE ESTATES	0.075
17	GULF SER. STA. KY 329	0.001
18	SOUTH OLDHAM MID. SCHOOL	0.030
19	CRESTVIEW APTS #1	0.002
20	EDGEWOOD APARTMENTS	0.002
21	SUNOCO SERV. STATION	0.001
22	THRESCO	0.005
23	SUBURBAN PARK SUBDIV	0.060
24	CRESTWOOD PLAZA APTS	0.065
25	ORCHARD GRASS SUBDIV	0.300
26	WILLOW CREEK SUBDIV	0.150
27	M.S.D. (HITE CREEK)	4.000
28	PROSPECT (HUNTING CK SOUTH)	0.251
29	PRIVATE HOME	0.001
30	PRIVATE HOME	0.001
31	TIMBERLAKE SUBDIVISION	0.200
32	COVERED BRIDGE SUBDIV 001	0.040
33	COUNTRYSIDE ESTATE SUB.	0.065
34	PROSPECT, HUNT. CK NORTH	0.350
35	M.S.D. (KEN CARLA SD)	0.010
36	SHADOW WOOD SUBDIVISION	0.085
TOTAL DESIGN FLOW		7.133

*MOST FACILITIES OPERATE AT LESS THAN DESIGN FLOWS

Table 2. Location of Water Quality Sampling Stations

<u>Station #</u>	<u>Description</u>
1	Harrods Creek at Highway 1694 bridge, milepoint 12.3
2	Harrods Creek above Paramont Estates Subdivision STP, milepoint 8.9
3	Harrods Creek at Highway 329 bridge, milepoint 6.9
4	South Fork Harrods Creek at Highway 1694 bridge, milepoint 1.4
5	Harrods Creek at edge of backwater area, milepoint 4.2
6	Harrods Creek above Hunting Creek South STP and milepoint 3.6
7	Wolf Pen Branch at mouth
8	Harrods Creek above Timberlake STP, below Wolf Pen Branch, at milepoint 2.6
9	Unnamed tributary above Putney's Pond, milepoint 0.60
10	Harrods Creek at Highway 42 bridge, milepoint 1.5
11	Harrods Creek near mouth, milepoint 0.20

Data Collection

Water quality samples were collected at 11 stream stations and the outfalls from Paramount Estates-, , Hunting Creek South, and Timberlake wastewater facilities during relatively low-flow conditions on July 10 and 11, 1990. Weather conditions on July 10 were hot and sunny, with air temperatures exceeding 95°F. July 11 was overcast, with air temperatures about 82°F. In addition to these samples, instantaneous measurements for dissolved oxygen and temperature were made at numerous locations and depths in the study area using Yellow Springs Instrument meters. Dissolved oxygen and temperature were also measured hourly for 24 hours at four locations in Harrods Creek using Hydrolab automatic data sonde units. These units were placed in Harrods Creek on July 10 and 11 at mile 3.6 (above Hunting Creek South STP), mile 3.3 (below Hunting Creek South), mile 2.2 (below Timberlake STP), and mile 1.5 at the Highway 42 bridge. Units were placed at a depth of about 4 feet. All field meters were calibrated on-site, while the sonde units were calibrated in the office the day prior to deployment. Check measurements using the Winkler titration method were done periodically to ensure meter accuracy. Water samples were collected mid-channel about 2 feet deep by boat in the backwater areas and by wading in the upstream areas.

Although conditions for this study were considered low-flow, comparison to flow measurements made by the USGS in 1987 indicated that streamflow in Harrods Creek can be considerably lower than that measured for this study. The USGS measured 0.54 cubic feet per second (cfs) on September 23, 1987, and 0.82 cfs on October 20, 1987, in Harrods Creek at the Highway 393 bridge (site 3), while 4.94 cfs was measured during this study. A flow of 1.13 cfs was measured by the USGS in South Fork Harrods Creek at the Highway 1694 bridge (site 4) on September 23, 1987, but was 3.14 cfs for this study.

Water Quality in Harrods Creek

Nearly 3 miles of lower Harrods Creek fails to meet Kentucky's minimum daily average dissolved oxygen standard of 5.0 mg/L (Figure 2, Table 3). Dissolved oxygen (DO) decreased from 11.0 mg/L at mile 12.3 to a low of 2.2 mg/L at mile 1.6. Dissolved oxygen increased to 3.4 mg/L at mile 0.2, while DO in the Ohio River near the mouth of Harrods Creek was 5.5 mg/L. Measurements plotted on Figure 2 were collected on July 10 over the course of the day. Those plotted from data in the backwater area were collected at mid-channel, at a depth of 5 feet. The Ohio River measurement plotted on figure 2 was also made at a depth of 5 feet. Profiles of dissolved oxygen and temperature were conducted on July 10 at several locations to determine variability throughout the water column (Table 4). Stations sampled in the afternoon exhibited DO stratification apparently resulting from photosynthesis in the upper 5 feet of the water column. The station at mile 1.5 was sampled both in the morning and late afternoon. only the afternoon sample exhibited stratification.

Dissolved oxygen concentrations in water are inversely related to temperature; the higher the water temperature, the lower the amount of oxygen that water can absorb. Because water temperature varied over the course of the study, it is useful to compare measured DO concentrations with the corresponding saturation points. Water with DO levels at saturation are in equilibrium; oxygen used in respiration and waste assimilation is balanced by oxygen production from algae and reaeration from the atmosphere. Water with DO above this point is supersaturated, which can be caused by swift riffles, waterfalls, and photosynthesis. Water with DO below this point is deficient, which indicates oxygen production and reaeration are insufficient to match oxygen demand. In streams this is generally the result of organic inputs. Table 5 presents the differences between measured DO and saturation values in Harrods Creek, which shows supersaturation in the upstream areas and large deficits in the backwater area.

Dissolved oxygen and temperature measurements made once per hour for 24 hours at four locations in the backwater area provided information on daily cycles. DO concentrations at mile 3.6, about 0.2 miles above the Hunting Creek South wastewater facility, were fairly stable and did not violate the DO standard at any time over the sampling period (Figure 3). A typical cycle of increasing levels during daylight hours and decreasing levels at night was not observed, probably because little photosynthesis was occurring at this location and depth. Temperature varied from 26.2 to 27.0 degrees Centigrade (°C). Concentrations at mile 3.3, about

Fig. 2. Dissolved Oxygen Concentrations in Harrods Creek

